

Figure 3. Shape of outer primaries of left wings in *Atthis ellioti* (left, FMNH 42768) and *A. heloisa* (right, KU 46137), both adult males.

This notch of the inner web of the outer primary in *A. heloisa* is the most extreme within the five closely related genera *Selasphorus*, *Atthis*, *Archilochus*, *Calypte*, and *Stellula*. The latter three genera and *Selasphorus flammula* show no notch of the outer primary, whereas *S. platycercus* shows a notch of the distal portion of the feather only. Other *Selasphorus* (*S. rufus*, *S. sasin*, and *S. scintilla*; *S. ardens* not determined) have a pointed outer primary, but no notch.

The colour of the two *Atthis* forms' gorgets differs, in that gorgets of *A. heloisa* are of a rich magenta purple or bluish purple, but those of *A. ellioti* lack blue almost completely and are decidedly more reddish, especially in Honduran *A. e. selasphoroides* (Monroe 1968), even when specimens of similar time since collection are compared. Additionally, the length of the gorgets of adult males may differ, although this feature is difficult to evaluate quantitatively; gorgets of *A. ellioti* seem to be about 3–5 mm longer than those of *A. heloisa*. Our measurements of body dimensions were based on too few individuals to permit statistical testing, but seem generally to support the notion that *A. ellioti* is somewhat smaller than *A. heloisa* in bill and tail length, but slightly larger in wing length, as documented by Ridgway (1892, 1911).

Species limits

The sum of the information presented above is that the northern and southern forms of *Atthis* differ in several regards. The two forms differ in courtship behaviour, song structure, wing morphology, and

coloration. Character distributions are nonoverlapping in several cases, and their status as valid phylogenetic species is unquestionable.

The unresolved question, however, is whether they should be considered as representing two biological species. Because of their allopatric distributions, no test of sympatry is available to aid in this decision. Comparisons with sympatric species pairs in related genera are not illuminating because sympatry among congeners (e.g. *Calypte* spp.) is relatively rare; however, species pairs in more distantly related hummingbird clades (e.g. *Amazilia* spp.) are maintained in sympatry even though they are more similar in courtship behaviours than the *Atthis* species treated herein. The marked differences in courtship behaviour and associated morphological modifications strongly suggest that they would not interbreed were populations to come into contact. Hence, we recommend that these two forms be recognized as full biological species.

Acknowledgements

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A new taxon of the Barred Honeybuzzard *Pernis celebensis* from the Philippines

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The Barred Honeybuzzard *Pernis celebensis* is restricted to Sulawesi and the Philippines. Two subspecies have been distinguished: The very colourful and uncrested nominate subspecies *Pernis celebensis celebensis* Wallace, 1868, is found on Sulawesi, including Muna and Peleng Islands; the paler banded and crested *Pernis celebensis steerei* Sclater, 1919, has been reported from all over the Philippines, except Palawan (Delacour & Mayr 1946, Brown & Amadon 1969, del Hoyo *et al.* 1994). Dickinson *et al.* (1991) compiled a list of 17 islands where the occurrence of this subspecies has been documented.

In the course of an ecomorphological study of Philippine birds of prey (Gamauf *et al.* 1998) we carried out morphological measurements on 21 raptor species in various museum collections. Sixty external measurements were taken from each specimen. While comparing the specimens from different Philippine islands, we were struck by clearcut differences in colour and plumage pattern among birds from northern and southern provenances. To investigate these geographic differences in greater detail, we looked for representatives of this species in 30

different museum collections. Finally, from nine museums (for abbreviations of museum names, see Acknowledgements), a total of 37 specimens was available, from 10 different islands. In addition, 75 observations in the field were available, carried out over a period of more than 9.5 months.

Plumage variation

The most striking difference between the two population groups is the uniformly brown colour of the adults in the northern population which does not display the rich contrast and coloration of specimens from the southern islands. This may be the reason for some confusion in the past concerning age classes, since plumage characteristics were often used to determine age (Stresemann 1940, Brown & Amadon 1969). The holotype of *steerei* (Sclater 1919), now in the Natural History Museum, Tring—BM 1896.4.15.40, is an adult male of the south Philippine subspecies which was collected by Steere on 17 February 1888, in San Antonio (Negros). We agree with Sclater's statement that "... other examples from Samar, Mindanao, and Basilan closely resemble the type ...", since we were able to confirm the occurrence of representatives of the southern population on those islands.

Morphological variation

Table 1 gives a comparison of 14 external morphological measurements of individuals from northern and southern provenances. From the total of 37 specimens we could include 29 sexed and fully feathered birds in a discriminant function analysis (12 from the north and 17 from the south). With a combination of 6 variables (Fig. 1) we were able to discriminate unambiguously between populations as well as between age classes. In the northern population the separation according to sex and age class was clearcut without any overlap: females are larger than males, immatures are smaller than older birds (adults and subadults) in some measurements. In the slightly smaller southern form no clear discrimination was found between the sexes. This may be partly due to incorrect sexing of the museum specimens, as has been proven for other species with much more pronounced sexual dimorphism. Nevertheless, the age class could be determined correctly. Discriminant function (DF) 1 concerns characters related to the mode of handling the prey as well as the flight apparatus. It segregates the subspecies largely by the length of the bill and middle toe. A negative correlation exists with the number of notches and Kipp's distance. Along DF 2 the honeybuzzards fall into two distinct groups largely according to the length of the tail as a character for flight (lift and ability for manoeuvring) and the tarsus length (presumably connected with feeding habits).

Thus, based on the characters discussed above, the northern population is distinct in both plumage pattern and morphology. Every specimen can be clearly diagnosed. We therefore consider this population to represent a third taxon, for which we propose the name

TABLE 1
Morphological measurements (mm) of the two Philippine populations of the Barred Honeybuzzard *Pernis ptilorhynchus* according to age and sex.
Numbers of study skins are given in parentheses. F = female, M = male

Age and sex	Northern population (<i>winkleri</i>)														
	Holotype Adult M (1)			Adult and subadult M (5) ¹			Adult and subadult F (5)			Immature M (3)			Immature F (1)		
	\bar{x}	s.d.	Range	\bar{x}	s.d.	Range	\bar{x}	s.d.	Range	\bar{x}	s.d.	Range	\bar{x}	s.d.	Range
Body length	530.0	8.3	530.0-553.0	556.4	24.8	520.0-590.0	561.0	27.9	525.0-593.0	535.0			535.0		
Wing length	375.0	3.6	367.0-376.0	395.6	12.0	375.0-408.0	366.7	13.4	348.0-379.0	363.0			363.0		
Kipp's distance	113.0	4.2	103.0-115.0	116.8	3.8	112.0-123.0	115.0	4.3	111.0-121.0	125.0			125.0		
Number of notches	7.0	0.0	7.0-7.0	7.0	0.0	7.0-7.0	6.3	0.5	6.0-7.0	7.0			7.0		
Length of central tail feather	245.0	240.8	7.5	226.0-260.0	241.4	9.8	222.0-267.0	235.0	6.2	227.0-247.0	230.0			230.0	
Length of outermost tail feather	251.0	246.8	10.8	227.0-260.0	254.4	6.7	247.0-267.0	239.3	9.5	226.0-247.0	227.0			227.0	
Length of hindtoe	21.4	22.7	1.4	21.4-25.2	22.5	2.2	20.0-25.8	24.1	3.0	20.0-27.1	27.7			27.7	
Length of middle toe	42.2	44.2	1.5	42.2-46.0	41.8	2.1	39.0-44.2	45.5	0.5	45.0-46.0	45.5			45.5	
Length of hindclaw	—	21.5	0.6	21.0-22.5	21.5	0.6	20.5-22.3	21.8	0.9	20.9-23.0	20.4			20.4	
Length of middle claw	—	21.3	1.0	20.0-22.7	22.5	0.9	21.5-24.0	22.1	0.7	21.6-23.1	20.0			20.0	
Tarsus length	40.2	42.3	2.3	40.0-46.0	41.7	2.7	40.0-47.0	41.3	2.4	38.0-43.0	44.0			44.0	
Bill length with cere	37.9	38.2	0.4	37.8-38.8	37.2	1.9	35.0-40.6	37.2	1.5	35.6-38.7	36.8			36.8	
Bill width with distal edge of cere	21.7	23.0	1.1	21.7-24.1	24.3	0.8	23.5-25.6	22.9	0.1	22.8-23.1	24.0			24.0	
Bill depth	17.9	18.4	0.5	17.9-19.0	18.5	0.7	17.5-19.5	19.2	0.0	19.2-19.2	—			—	

¹ Holotype included

TABLE 1 (Continued)

Age and sex	Southern population (<i>steerei</i>)					
	Adult and subadult M (12)			Adult and subadult F (4)		
	\bar{x}	s.d.	Range	\bar{x}	s.d.	Range
Body length	529.0	9.9	525.0-542.0	554.8	15.2	533.0-575.0
Wing length	371.6	10.7	355.0-395.0	381.0	4.9	375.0-388.0
Kipp's distance	110.5	6.1	102.0-125.0	115.3	3.1	112.0-120.0
Number of notches	7.3	0.7	6.0-9.0	7.3	0.4	7.0-8.0
Length of central tail feather	229.5	10.5	212.0-251.0	241.0	6.4	231.0-245.0
Length of outermost tail feather	236.6	9.0	223.0-251.0	242.8	3.3	237.0-245.0
Length of hindtoe	22.9	1.0	21.3-24.3	22.8	0.6	22.0-23.4
Length of middle toe	40.9	1.8	38.5-43.9	43.0	1.6	41.0-45.4
Length of hindclaw	20.4	1.1	19.0-22.4	20.8	0.9	19.6-22.2
Length of middle claw	21.1	0.9	19.5-22.5	21.8	1.2	20.2-23.0
Tarsus length	40.2	2.1	38.0-46.0	39.1	2.2	37.0-42.0
Bill length with cere	35.6	0.7	34.0-37.0	35.1	0.7	33.9-35.7
Bill width of distal edge of cere	23.2	1.6	20.5-25.8	22.6	1.6	20.5-25.0
Bill depth	17.5	1.2	15.4-19.3	16.8	0.5	16.2-17.3
					Immature M (1)	Immature F (1)
					582.0	553.0
					361.0	381.0
					117.0	110.0
					7.0	7.0
					249.0	242.0
					252.0	265.0
					22.4	26.7
					40.5	38.6
					19.3	24.0
					19.8	22.4
					38.0	39.8
					35.5	35.0
					23.7	21.5
					—	18.2

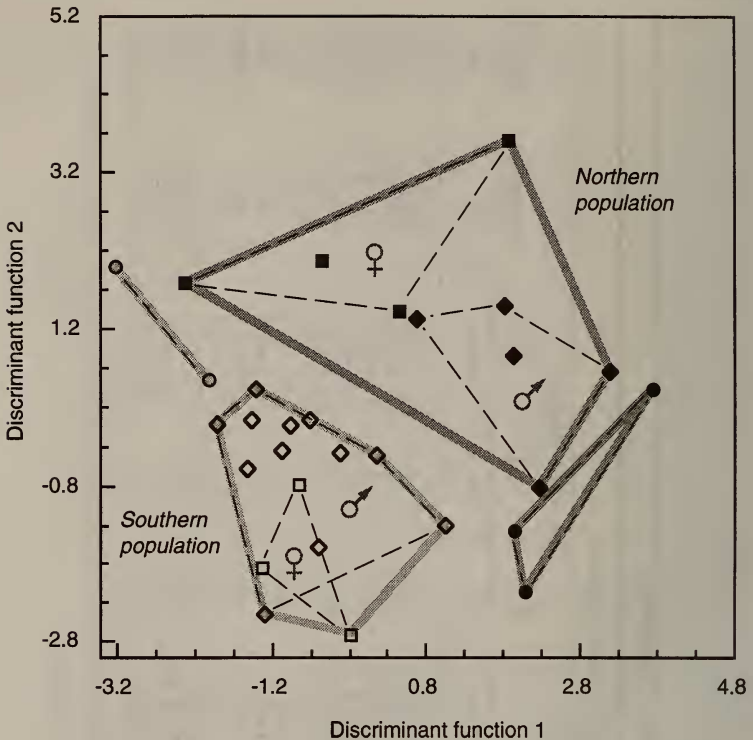


Figure 1. Separation of the two Philippine populations of the Barred Honeybuzzard *Pernis celebensis* (12 study skins from the north, filled symbols; 17 study skins from the south, open symbols) according to discriminant function analysis of 6 morphological variables (bill length, length of the middle toe, number of notches, Kipp's distance, length of the tail, tarsus length). Immatures are marked by round symbols.

Pernis celebensis winkleri subsp. nov.

Holotype. Adult male, from Bataan, Luzon, collected by O. Koch, 17 August 1881, Zoologisches Museum der Humboldt Universität Berlin, Germany, cat. no. ZMB 25.464 (Fig. 2). This is the specimen listed as "immature?" by Stresemann (1940, pp. 192/193).

Diagnosis. The subspecies can be distinguished unequivocally in subadult and adult specimens. In contrast to *winkleri*, individuals of *steerei* are much more contrasting in plumage. The ground colour of crown and neck is paler with dark stripes, the long pointed crest (up to 73 mm) is black. The throat is white with black mesial and lateral stripes. The breast is whitish with buffy with bold black streaks. The lower breast is white with narrow rufous-brown bars. Lower belly, undertail coverts, leg feathers and underwing coverts are barred medium to dark brown and white. All illustrations in publications to date show *steerei* (duPont 1971, Brown & Amadon 1969, Weick 1980,

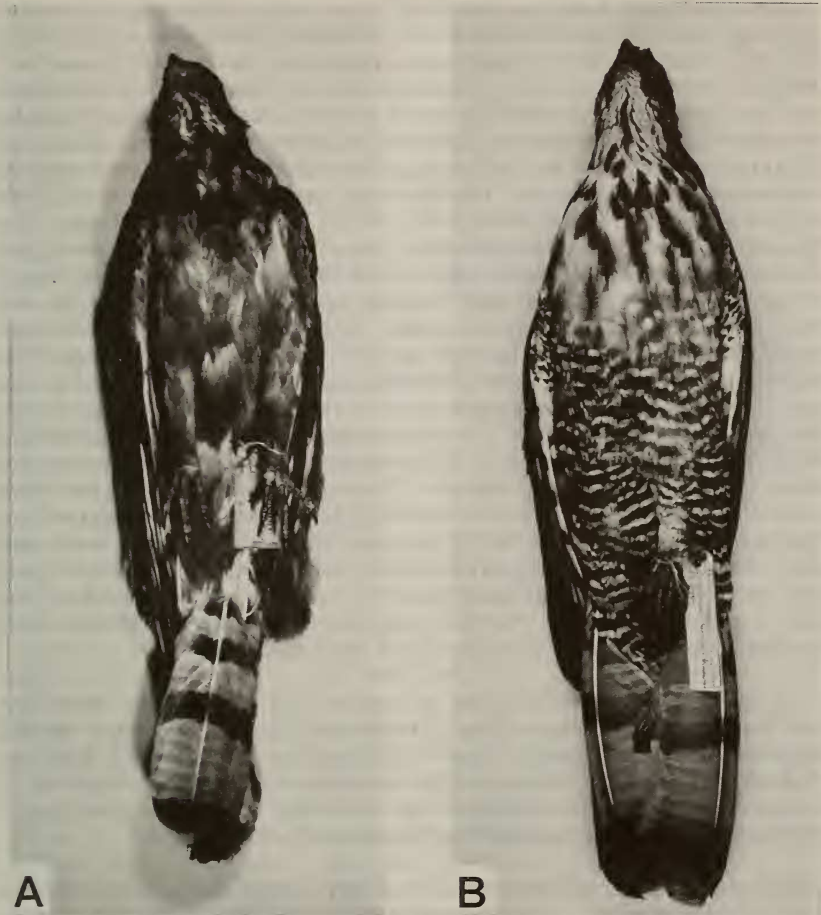


Figure 2. A. Holotype of *Pernis celebensis winkleri* subsp. nov. (Zoologisches Museum der Humboldt Universität Berlin, Germany, cat. no. ZMB 25.464). B. Typical adult representative of *Pernis celebensis steerei*, Universitets Zoologiske Museum, København, Denmark, cat. no. 940).

del Hoyo *et al.* 1994). In the course of our investigations we discovered several misidentified specimens among study skins, as was also noted by Dickinson *et al.* (1989). These obvious errors are due to close similarities between corresponding subspecies of the Philippine Hawk-Eagle *Spizaetus philippensis* (Preleuthner & Gamauf 1998) and of the Banded Honeybuzzard *Pernis celebensis*. The respective northern subspecies from both species resemble each other, as also is the case with the southern subspecies. Whether this could be caused by mimicry will be discussed elsewhere.

Description of holotype. Generally a dark uniformly brownish coloured bird. Especially as the holotype was originally a mounted specimen, the slender honeybuzzard form can be easily recognised. Crown and the sides of the head are hazel to blackish-brown with fine black streaks on the sides and with broader black streaks on the crown. The short bluish-grey imbricated feathers extending from the lores to the supercilium and the anterior part of the auriculars, together with additional morphological measurements, suggest that the specimen may be sexed as male. The longest lanceolate feather of its pointed crest has a length of 57 mm. The throat is buffy white and every feather has a black shaft. Additionally, the throat is divided by a black median stripe and bordered by black lateral moustachial stripes. The breast feathers are hazel to cinnamon brown with more or less bold black streaks. Belly and undertail coverts are uniform cinnamon brown like the underwing coverts and the legs. The plumage of the anterior part of the legs covers the upper third of the short tarsus. The primaries are barred on their distal part, the proximal part is indistinctly mottled. The wing-shape is typical for a forest-living honeybuzzard, relatively short and rounded, and the wing tips extend more than halfway to the tail tip. The upperparts are uniform dark umber to sepia brown, with narrow paler edges; the primaries are blackish-brown. The long tail is the same ground colour on the dorsal side, the broad black subterminal bar separated by a broader pale greyish-brown unmarked zone from 3–4 narrower bars basally. The cere is dark grey and the bill black, only the innermost half of the lower mandible is warm buff. The legs are a deep yellow.

Etymology. We have chosen to name this subspecies after the well-known ornithologist Prof. Dr Hans Winkler, director of the Konrad Lorenz-Institute for Comparative Ethology, Austrian Academy of Sciences, and expert in the field of ecoethology. We wish to emphasise our appreciation of his scientific competence and our gratitude for his patience and encouragement of our work.

Paratypes. Eight specimens of *winkleri* from Luzon are herein designated paratypes (1 adult male and 4 subadult/adult females, 2 immature males and 1 immature female). Adult male, 05.06.1894, Molino, Isabela Province; BMNH, cat. no. 394.6.14.13. Adult female, 15.03.1894, La Trinidad, Benguet Sub-province, Mountain Province; BMNH, cat. no. 334.99.14.12. Adult female, 27.07.1894, Manito, Albay Province; BMNH, cat. no. 399.97.5-13.143. Subadult female, 01.08.1959, Pangil, N.A. Icarangal, Laguna Province; AMNH, cat. no. 782423. Subadult female, 01.12.1969, Ipo Dam, Bulacan Province; DMNH, cat. no. 3622. Immature male, 02.07.1958, Bataan Province, J. E. duPont; DMNH, cat. no. 1300. Immature female, Saray, Pakil, Laguna Province; DMNH, cat. no. 43724. Immature male, 30.03.1975, Diman, Pangil, Laguna Province; CMNH, cat. no. 47656. Seven additional study skins of the northern population were available from Polillo (1 immature, AMNH), Catanduanes Island (1 unsexed subadult, DMNH; 1 immature male, PNM; 1 juvenile female, PNM), Marinduque Island (1 subadult male, DMNH), and Sibuyan Island (1

subadult male, DMNH). One adult female, without designated locality (BMNH, cat. no. 1057), belongs also the subspecies *winkleri*.

Plumages. Adult: All adult birds are dark and with little contrast. The crown and the side of the head are buffy to blackish brown with heavy streaks broadening towards the crown. *Winkleri* is characterised by a prominent pointed crest (up to 60 mm). Adult males show bluish-grey feathers at the side of the head as described for the holotype. In adult females, the bluish-grey zone covers only the lores; but this characteristic appears also in the other two subspecies. In comparison to *Pernis apivorus* and *Pernis ptilorhyncus* this zone is clearly smaller, especially in males. The colour of the iris is bright yellow, cere and bill are dark grey to black. The throat is white to buffy white, often with fine black longitudinal stripes along the shafts, divided by a black median stripe and bordered by black lateral moustachial stripes. Breast feathers are chestnut to hazel with more or less bold black streaks. Lower breast and belly are uniformly chestnut brown. The feathered tibiotarsus and the undertail coverts are cinnamon. The underwing coverts are either uniformly coloured or of a mottled brown showing no bars whatsoever. The upperparts including the tail are uniformly coloured, umber to sepia with somewhat darker primaries. Freshly acquired wing and tail feathers are tipped with white. The long tail feathers have a broad black subterminal bar adjacent to a broader unmarked zone and usually 5–6, occasionally up to 7, narrower dark bars basally. The innermost bars are narrow and closely spaced. They are barely visible in perching birds. The full coloration is acquired approximately at the age of 3 years, as is the case with *P. apivorus* and probably also *P. ptilorhyncus*. Second year plumage: The feathers at the crown and the neck are paler than in adults. A tawny mask is clearly visible. The typical bluish-grey feathered zone is already developed. The characteristic throat pattern with the black mesial stripe and the lateral moustachial stripes is less contrasting and pronounced than in the adult. The breast is white to buffy with more or less distinct streaks. Lower belly, legs and undertail coverts are usually darker. The underwing coverts are buffy to washed brownish without pattern. Only in one specimen chestnut axillary patches could be observed. The pale band on the upperwing (present in the first-year plumage) becomes darker, smaller and also more indistinct. Pattern and colouring of primaries, secondaries and tail feathers generally resemble the adult plumage. Immature: The first-year ventral plumage is white (only in one specimen buffy) and there is almost no variation, unlike the immatures of *P. apivorus* or *P. ptilorhyncus orientalis*. The head is white, neck and crown are whitish to buffy with fine dark streaks. The long pointed crest is black and clearly visible. A blackish mask in the form of a dark eyeline reaches from the bill to the auriculars. The cere is yellow, the bill blackish-grey and the inner half of the lower mandible warm buff to yellowish. On the ventral side the distal half of the primaries is blackish-brown, with up to 8 bars on the longest primary (usually the 6th). On the proximal half the bars are reduced; the wing-base, therefore, appears almost white. The secondaries are greyish-brown with bars less contrasting than in the adult plumage.

The back is sepia brown, and the uppertail coverts vary from cinnamon to buffy and whitish. Especially the greater and median wing coverts show wide pale edgings, which were, however, lacking in a few newly fledged birds. The secondaries are of a deep sepia colour, the primaries blackish brown. The tail feathers are sepia with 6–8 regularly spaced bars, in some individuals the areas between the bands becoming increasingly more closely set towards the tail-base. Feather tips are white and more pointed than in adults. The feet are yellow. Presumably, based on his knowledge of the European Honeybuzzard *P. apivorus*, Stresemann (1940) assumed that the specimen here designated the holotype of *winkleri* might be immature. This misinterpretation was due to the fact that most juveniles of *P. apivorus* are almost exclusively brown on the ventral side and thus resemble the adults of *winkleri*.

Specimens examined. Including the holotype, 16 study skins of *winkleri* were available from 5 different museum collections (see above), for *steerei* 21 study skins were examined at 7 collections (BMNH 5, UPLB 4, PNM 3, USNM 3, DMNH 3, AMNH 2, UMZC 1). In the course of our study *winkleri* has not been observed in the field, whereas 75 observations of *steerei* were recorded, all on Mindanao. Altogether this species could be observed for 7.41 hours between January and April 1993, November 1993 to February 1994, and March to July 1994.

Distribution. The occurrence of *winkleri* on Luzon (9), Polillo (1), Catanduanes (3), Marinduque (1), and Sibuyan (1) is documented by the study skins mentioned above. For *steerei*, specimens were available from Samar (5), Negros (1), Siargao (1), Mindanao (11), and Basilan (3). According to these data, in the east the borderline between the two subspecies runs along the Bernardino Strait between Luzon and Samar. Towards the west it follows the Sibuyan Sea south of Romblon. Since no study skins from Mindoro could be found during our investigations, the division line remains uncertain for the western part of the Philippine Archipelago. According to literature compiled by Dickinson *et al.* (1991) *P. celebensis* has been documented for seven additional islands. From our distribution data it can be concluded that six of those islands (Leyte, Tablas, Bohol, Tawitawi, Dinagat, Masbate) are inhabited by *steerei*, whereas Romblon, because of the close vicinity to Sibuyan, may probably be inhabited by *winkleri*. The present borderline between the two subspecies can be interpreted as the result of changes in the sea level during the Pleistocene (Diamond & Gilpin 1983, Heaney 1985), as discussed in Preleuthner & Gamauf (1998).

Habitat and conservation. The Barred Honeybuzzard is morphologically adapted to tropical rainforests (Gamauf *et al.* 1998). More than half of the 75 observations (*steerei*) have been made in lowland primary rainforests or secondary forests selectively logged 2–3 decades ago. The habitat choice of lowland areas is confirmed by our findings in the field as well as by the label data of the skins examined. Half of the observations were made at altitudes between 90 and 200 m a.s.l., the rest more or less evenly distributed up to 1400 m a.s.l. (highest location 1550 m a.s.l.). Of 11 skins bearing altitudinal data, 9 originate from areas between sea level and 400 m a.s.l. Another specimen of *steerei* was

collected between 610 and 760 m a.s.l. (Goodman & Gonzales 1990). As has been shown by Collins *et al.* (1991), the condition especially of the lowland forests is rather poor. The major part of the rainforest has been lost due to logging and *kaingin* (shifting cultivation) activities. In 1988 only about 17 700 km² of intact lowland forest still existed. The recent extent of the rainforest is not exactly known, but considering the prior deforestation rate the present range of the potential habitat for *winkleri* can be estimated at 5000 km², for *steerei* at 7500 km² only (Preleuthner & Gamauf 1998). While according to Hauge *et al.* (1986) the Philippines ranked high among tropical countries in the rate of deforestation, as well as in the extent of deforested area in the 1980s, some years later Collins *et al.* (1991) classified the Philippines as arguably the worst case in tropical Asia.

Steerei was found at four study sites on Mindanao (NW and E Mt. Kitanglad area/Bukidnon, Carmen-Cantilan and PRI, former PICOP/Surigao del Sur). For these four areas population densities were estimated. In the lowland forests of PRI (58 km², 90–180 m a.s.l.) we found 7–8 pairs (12–14/100 km²) and in Carmen-Cantilan (27 km², 80–540 m a.s.l.) 2–3 pairs (7–11/100 km²). The density at higher elevations was up to 2.6 times lower than in these lowland areas. At NW Mt. Kitanglad (590–1400 m a.s.l.) 3–4 pairs were found in 45 km² (7–9 pairs/100 km²), and on the eastern side of the same massif (900–1800 m a.s.l.) 2 pairs were resident in the lower part of the 38 km² study site (5 pairs/100 km²). A population density of 8.3–10 pairs/100 km² was taken as a basis for estimating the total number for both populations, because *winkleri* could not be observed in the field. According to these calculations 400–500 pairs of *winkleri* may still live in the potential habitat of 5000 km². Using the same approach for *steerei* the corresponding number is 600–750 pairs in an area of 7500 km² of potential habitat. However, the actual number of *winkleri* may be much smaller since Danielsen *et al.* (1993) have classified the Barred Honeybuzzard as scarce for the Sierra Madre region, Luzon, and *steerei* could not be found at Mindoro, Negros and Sibuyan in recent studies (Brooks *et al.* 1992, Dutton *et al.* 1992, Evans *et al.* 1993).

P. celebensis has not yet been included in the world list of threatened birds (Collar *et al.* 1994). Based on our recent investigations, at least one criterion for this classification would be fulfilled: population numbers of all three subspecies are lower than 10 000 mature individuals. Additionally, the highly fragmented habitat is still subject to further destruction by continued logging, shifting agriculture and soil erosion. We therefore propose to include *P. celebensis* into the IUCN category "vulnerable".

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